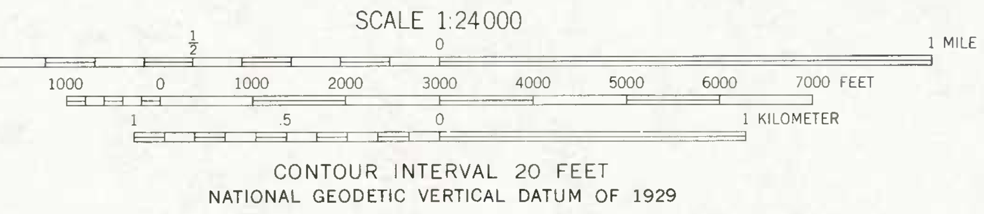
Maryland Geological Survey

MAP 1. SLOPE OF LAND SURFACE

Quadrangle Atlas No. 21



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

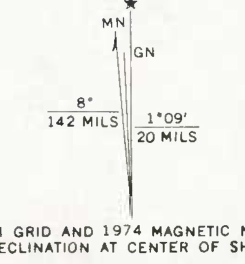
EXPLANATION

This map shows the slope of the land surface in the Ellicott City quadrangle, with the slope values grouped into categories. The map was prepared from a 1:24,000-scale topographic contour plate using a semi-automatic photomechanical process. In this process, a device measures the distance between adjacent lines and, for the contour interval provided, calculates the slope between the lines. Narrow summits or depressions and similar features may be falsely mapped due to the bending of a line upon itself. Likewise, equal but adjacent contours produce over-estimated slopes. Widely separated contour lines may result in an averaging of the intervening slopes. These limitations are only of limited significance. The slope categories which relate to those in the Baltimore County Soil Survey were selected for their relevance to current and contemplated Baltimore County planning regulations.

1983

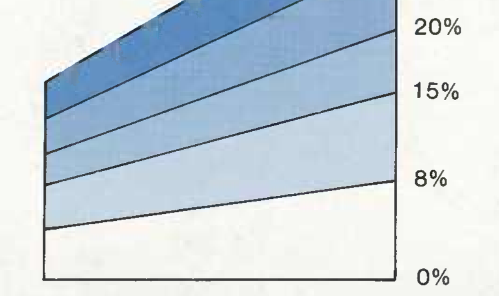
Prepared in cooperation with the
United States Geological Survey
and the
Baltimore County Department of
Planning and Zoning.

QUADRANGLE LOCATION



UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Prepared by **Photo Science, Inc.**, Gaithersburg Maryland. Utilizing contour negatives, furnished by United States Geological Survey.



LOCATION OF WELLS AND SPRINGS

By Mark T. Duigon

EXPLANATION

Information for some of the wells on this map (comprising earlier inventories) is tabulated in the Maryland Geological Survey Basic Data Report No. 1 (Laughlin, 1966), and in Bulletin 14 (Dingman and Meyer, 1954). Supplementary wells in Baltimore County are tabulated in this report. The supplementary well information has been entered in the National Water Data Storage and Retrieval System (WATSTORE) of the U.S. Geological Survey.

Since 1945, the State of Maryland has required a permit to drill a water well in Maryland. The numbers corresponding to the permit applications are included in the well-data tabulations. Since 1973, metal tags bearing State permit numbers have been affixed to the well casings. Much of the well data collected for this report is contained on well-completion forms which the driller must submit to the State upon completion of the well. The manner in which the information is obtained can vary with each well driller. For example, discharge may be measured by filling a bucket, using a flowmeter, or estimation.

Wells are identified in accordance with a State-wide numbering system. Each county is set up with a grid system based on every fifth minute of latitude and longitude. Each square of the grid is lettered by row and column. Thus, well BA-EB 158 is the 158th well inventoried in the fifth row from the north, second column from the west, in Baltimore County.

○ 13 WATER WELL AND NUMBER

○ 89 SPRING AND NUMBER

REFERENCES

Dingman, R. J., and Meyer, Gerald, 1954, The ground-water resources, in The water resources of Howard and Montgomery Counties: Maryland Department of Geology, Mines and Water Resources[1/] Bulletin, v. 14, 260 p.

Laughlin, C. O., 1966, Records of wells and springs in Baltimore County, Maryland: Maryland Geological Survey Water Resources Basic Data Report No. 1, 406 p.

1/ The name of this agency was changed to the Maryland Geological Survey in June 1964.

SUPPLEMENTAL RECORD OF WELLS IN THE ELLICOTT CITY QUADRANGLE

LOCAL NUMBER	STATE PERMIT NUMBER	OWNER	CONTRACTOR	DATE COMPLETED	ALTITUDE OF LAND SURFACE (FEET)	DEPTH OF WELL (FEET)	FINISH	DEPTH CASED (FEET)	CASING DIAMETER (INCHES)	PRINCIPAL AQUIFER	WATER LEVEL (FEET)	DRAW-DOWN (FEET)	DISCHARGE (GALLONS PER MINUTE)	DATE DISCHARGE MEASURED	PUMPING PERIOD (HOURS)	SPECIFIC CAPACITY (GPM/FT)	USE OF WATER	USE OF SITE	TYPE OF LIFT
BA EA 82	BA-73-3860	ENSOR, MAURICE M	H J DILLON	03/01/1977	525	250.00	X	21	6	400BLMR	35.00	195	2.0	03/01/1977	6.0	0.0	H	W	S
BA EA 85	BA-73-0849	BIDDLE, EDWIN	L EASTERDAY	07/27/1973	520	160.00	X	33	6	400BLMR	40.00	120	10	07/27/1973	2.0	0.1	H	W	S
BA EA 86	BA-73-5036	SNYDER, CHARLES H	H J DILLON	11/21/1977	480	200.00	X	100	6	300WDCK	40.00	110	7.0	11/21/1977	6.0	0.1	H	W	S
BA EA 87	BA-73-4967	WONDERLY, EDWARD	C C CAMPBELL	10/21/1977	480	145.00	X	42	6	300WDCK	20.00	10	10	10/21/1977	6.0	1.0	H	W	S
BA EA 88	BA-73-5882	COLEIANNE, VINCENT	H J DILLON	07/28/1978	470	300.00	X	80	6	300WDCK	20.00	230	3.0	07/28/1978	6.0	0.0	H	W	S
BA FA 3	BA-73-2736	MATHENA, BREMEN	H J DILLON	02/10/1976	450	125.00	X	60	6	400BLMR	35.00	40	10	02/10/1976	6.0	0.3	H	W	S
BA FA 4	BA-73-5885	CONAWAY, JOHN	H J DILLON	07/17/1978	460	290.00	X	251	6	300OELL	105.00	10	10	07/17/1978	6.0	1.0	H	W	S
BA FA 5	BA-73-3801	HARRIS, MARGRET	H J DILLON	01/10/1977	440	175.00	X	115	6	300STRS	40.00	10	10	01/10/1977	6.0	1.0	H	W	S

FINISH CODES

X OPEN HOLE

PRINCIPAL AQUIFER CODES

400BLMR BALTIMORE GNEISS
300WDCK WOODSTOCK QUARTZ MONZONITE
300OELL OELLA FORMATION
300STRS SETTERS FORMATION

WATER USE CODES

H DOMESTIC

SITE USE CODES

W WITHDRAWAL

LIFT TYPE CODES

S SUBMERSIBLE

SUPPLEMENTAL RECORD OF SPRINGS IN THE ELLICOTT CITY QUADRANGLE

NUMBER	OWNER	ALTITUDE	TOPOGRAPHIC SETTING	AQUIFER	YIELD	DATE	TEMPERATURE	pH	USE OF WATER
BA-EA 89	Schlee, Inc.	450	hillside	300 Woodstock Granite	1	02/06/1979	3	6.9	unused
BA-EB 289	Hill, F.G.	490	hillside	400 Baltimore Gneiss	3	02/06/1979	3	6.9	unused
BA-EB 290	Mann, Thomas	460	hillside	400 Baltimore Gneiss	5	02/06/1979	4	6.9	unused

Prepared in cooperation with the
United States Geological Survey
and the
Baltimore County Department of
Planning and Zoning.

MAP 2. LOCATIONS OF WELLS AND SPRINGS

Topography from aerial photographs by photogrammetric methods. Aerial photographs taken 1943. Culture revised by the Geological Survey 1953. Photorevised 1974.

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1983

MARYLAND
QUADRANGLE LOCATION

DEPTH TO THE WATER TABLE

By
Mark T. Duigon

EXPLANATION

This map shows the distance from the land surface to the water table (top of the zone of saturation). The map is based on drillers' well-completion reports supplemented by soils maps and observations of springs, swamps, and other natural features. The map shows that the water table is generally shallowest near streams and deepest under summits of hills and ridges.

The position of the water table is not constant, but fluctuates in response to various stresses, chiefly precipitation and evapotranspiration. The water table is usually highest during the spring and deepest in late summer. Infiltrating precipitation tends to raise the water table, but much of this water may be removed by evapotranspiration before reaching the zone of saturation. Loss by evapotranspiration is most notable during the growing season. Fluctuations in the flow of springs may indicate changes in the position of the water table. A spring which usually flows all year may cease during a prolonged drought because the water table has declined to some point below the spring mouth. The map presented here is generalized, showing average depths to the water table.

Figure 1 shows a 19-year record of water levels in well BA-CE 21 measured periodically by the U.S. Geological Survey. This well, located near Jacksonville, Md., shows the seasonal variations that are characteristic of most wells. It also shows variations in annual mean levels.

A discharging well produces a lowering of the water table (drawdown), but, in the Piedmont, the effect is usually restricted to the immediate vicinity of the well, and as soon as the pump is shut off, the water level begins to return to its former level. The amount of drawdown varies considerably, depending on pumping rate, duration of pumping, and the hydrologic properties of the aquifer.

In some areas, rainwater infiltrating the ground encounters an impermeable barrier and saturates the soil above it, while the material below the barrier remains unsaturated. The surface of such a saturated zone is known as a perched water table. In the Piedmont, perched water tables are not as extensive as the main water table and are usually temporary. They are not shown on this map.

APPROXIMATE DEPTH TO WATER TABLE BELOW LAND SURFACE

Less than 10 feet

10 - 35 Feet

Greater than 35 feet

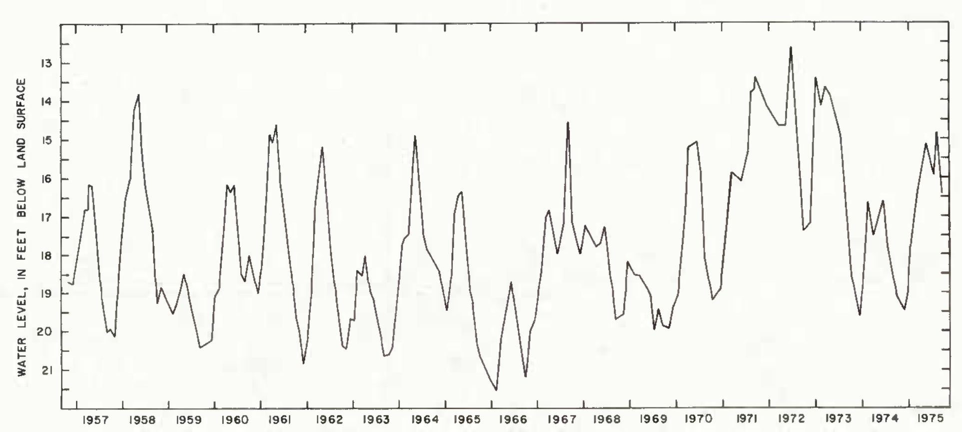


Figure 1. -- Hydrograph for well BA-CE 21, Jacksonville.

Prepared in cooperation with the
United States Geological Survey
and the
Baltimore County Department of
Planning and Zoning.

MAP 3. DEPTH TO WATER TABLE

Topography from aerial photographs by photogrammetric methods. Aerial photographs taken 1943. Culture revised by the Geological Survey 1953. Photorevised 1974.

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1983

QUADRANGLE LOCATION

AVAILABILITY OF GROUND WATER

by

Mark T. Duigon

WELL SITE SELECTION STRATEGIES

Well yields in the Ellicott City quadrangle exhibit a great degree of variability, even within small areas. Most domestic well sites are chosen to meet regulations with respect to lot boundaries, location of septic tanks, and other factors which do not relate to well yield. This practice limits the availability of well sites, especially on smaller lots. When greater yields are required, such as to supply commercial establishments, sites should be chosen more carefully.

Although the yield that a well will have cannot be predicted, it is possible to increase the probability of the well obtaining a sufficient yield if the optimum site is selected. The potential of a well site depends on such factors as rock type, topographic position, and extent of rock fractures. These factors can be evaluated using maps and aerial photographs, but need to be verified in the field.

The map presented here evaluates ground-water availability on the basis of geologic mapping units used by Crowley and Reinhardt (1980). This stratigraphic nomenclature does not necessarily follow the usage of the U.S. Geological Survey. Wells grouped by geologic unit were compared using the Kruskal-Wallis nonparametric statistical test. It was determined that three groups were present; these are described below.

EXPLANATION

UNIT I, underlain by Coastal Plain sediments, occurs elsewhere in Baltimore County. The Coastal Plain sediments in the Ellicott City quadrangle (Patuxent Formation) are too thin and restricted to be of any importance as an aquifer; wells in those areas are completed in the underlying crystalline bedrock.

2

GEOHYDROLOGIC UNIT 2: This unit is composed of areas underlain by Mount Washington Amphibolite, Hollofield Layered Ultramafite, and metadolostone present in some areas of the Rush Brook Member of the Loch Raven Schist.

Reported yields of 36 wells range from 1.3 to 40 gal/min. The median yield is 10 gal/min, and the mean is 11.6 gal/min. Figure 1 shows distribution of well yields calculated from specific capacities. Specific capacities range from 0.01 to 3.0 (gal/min)/ft. The median is 0.51 (gal/min)/ft; mean is 0.72 (gal/min)/ft. Well depths range from 25 ft below land surface to 750 ft; median depth is 69 ft.

Wells drilled in unit 2 will generally be adequate for domestic use, and, with proper construction and design may serve for some municipal, commercial, or industrial supplies.

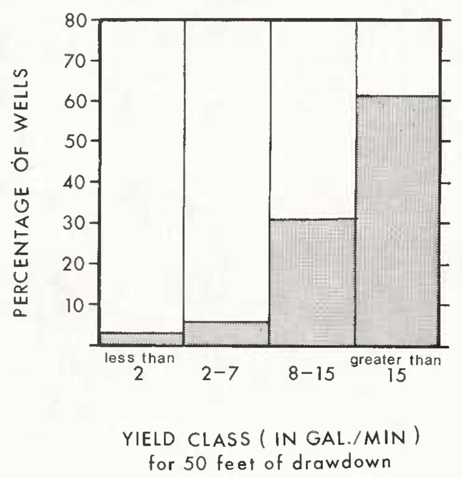


Figure 1. -- Distribution of well yields, Geohydrologic Unit 2 (36 wells).

3

GEOHYDROLOGIC UNIT 3: This unit covers over half of the Ellicott City quadrangle. It is underlain by a variety of rock types including granite, schist, quartzite, metalimestone, and gneiss.

Reported yields of 453 wells in the Ellicott City and nearby quadrangles range from 0 to 100 gal/min. Median yield is 6 gal/min and the mean is 8.4 gal/min. Figure 2 shows distribution of well yields calculated from specific capacities.

Values for specific capacity range from 0.00 to 6.1 (gal/min)/ft. The median is 0.14 (gal/min)/ft and the mean is 0.32 (gal/min)/ft. Because most of the wells analyzed in this group are domestic wells (usually located for convenience and regulation compliance), the statistics may underestimate the potential of the unit. Higher yields may be obtained by optimum site location and improved techniques of well construction and development, such as hydraulic fracturing of the aquifer.

Well depths range from 45 ft below land surface to 890 ft. Median depth is 145 ft.

Water quality varies in this unit, depending on the type of rock from which the water is derived. It is generally suitable for domestic use, but in some areas (underlain by schist or other acidic rocks) it may be rather acidic and require plastic plumbing or other special consideration to prevent reaction with solder and copper pipe.

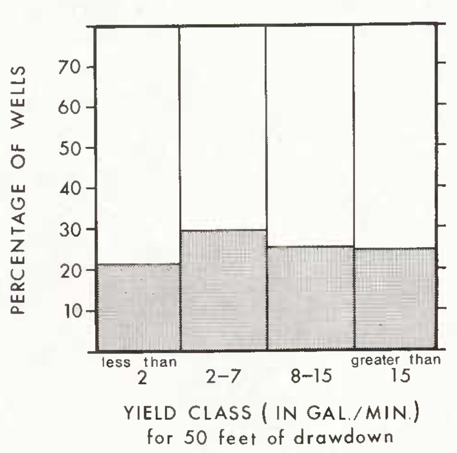


Figure 2. -- Distribution of well yields, Ceohydrologic Unit 3 (453 wells).

4

GEOHYDROLOGIC UNIT 4: This unit is composed of one small area underlain by the garnet-staurolite facies of the Loch Raven Schist and two areas underlain by the garnet-kyanite facies. This is the least productive unit with reported yields of 64 wells ranging from 0 to 60 gal/min. Median yield is 3 gal/min and the mean is 5.9 gal/min. Figure 3 shows the distribution of well yields calculated from specific capacities. Specific capacities range from 0.00 to 6.0 (gal/min)/ft. The median is 0.05 (gal/min)/ft and the mean is 0.33 (gal/min)/ft. Well depths range from 60 to 600 ft and the median depth is 172 ft.

The risk of being unable to obtain a well adequate for domestic use on the first attempt is rather high (22 percent of reported yields are less than the 2 gal/min considered adequate for domestic use). Wells are also, on the average, deeper in this unit and therefore more expensive. Homes in this unit, if not supplied by public water systems, may require specially designed water-supply systems and the use of conservation methods. (See, for example, Wright, 1977.) The likelihood of obtaining a well capable of meeting demands greater than a few gallons a minute is very low (9 percent of reported yields exceeded 10 gal/min), but the odds can be improved if the well site is carefully chosen with respect to geohydrological factors.

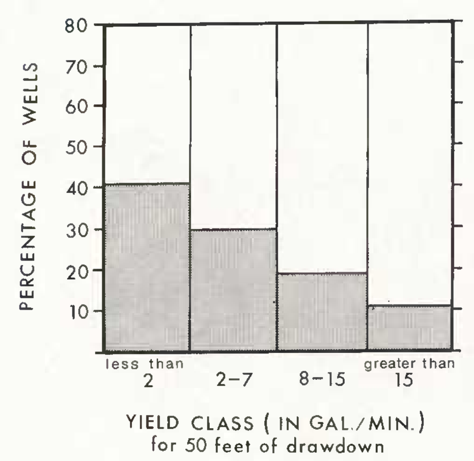


Figure 3. -- Distribution of well yields, Ceohydrologic Unit 4 (64 wells).

SUMMARY

Records of 553 wells analyzed for the Ellicott City quadrangle and vicinity range in reported yield from 0 to 100 gal/min; the median is 6 gal/min and the mean is 8.3 gal/min. Of the total number of wells analyzed, 13 percent were reported to yield less than the 2 gal/min considered in this report to be adequate for domestic use. (Specially designed water-supply systems may enable some lower-yielding wells to serve domestic needs; see, for example, Hunt, 1978). Specific capacities range from 0.00 to 6.1 (gal/min)/ft. Median specific capacity is 0.15 (gal/min)/ft, and the mean is 0.35 (gal/min)/ft. Figure 4 is a specific-capacity frequency graph which indicates the differences in distribution of specific capacity among the three geohydrologic units. Depths of wells range from 25 to 890 ft below land surface. Median well depth is 144 ft.

○ Well with reported yield less than 2 gal/min.

● Well with reported yield greater than 15 gal/min.

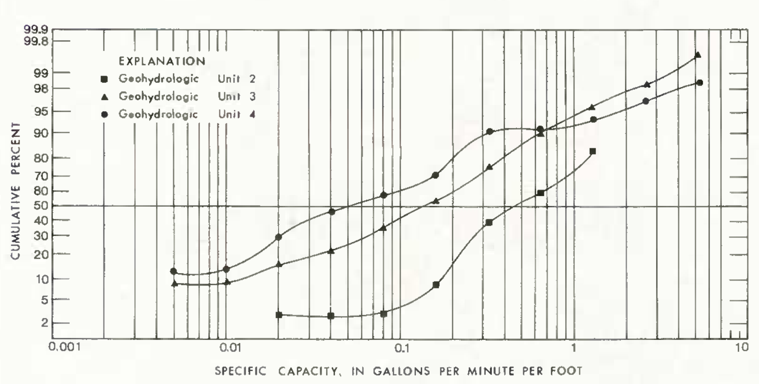


Figure 4. -- Cumulative frequencies of specific capacities of wells in the three Hydrogeologic Units.

REFERENCES

Crowley, W. P., 1976, The geology of the crystalline rocks near Baltimore and its bearing on the evolution of the eastern Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 27, 40 p.

Crowley, W. P., and Reinhardt, Juergen, 1980, Ceologic map of the Ellicott City quadrangle, Maryland: Maryland Geological Survey, scale 1:24,000, 1 sheet.

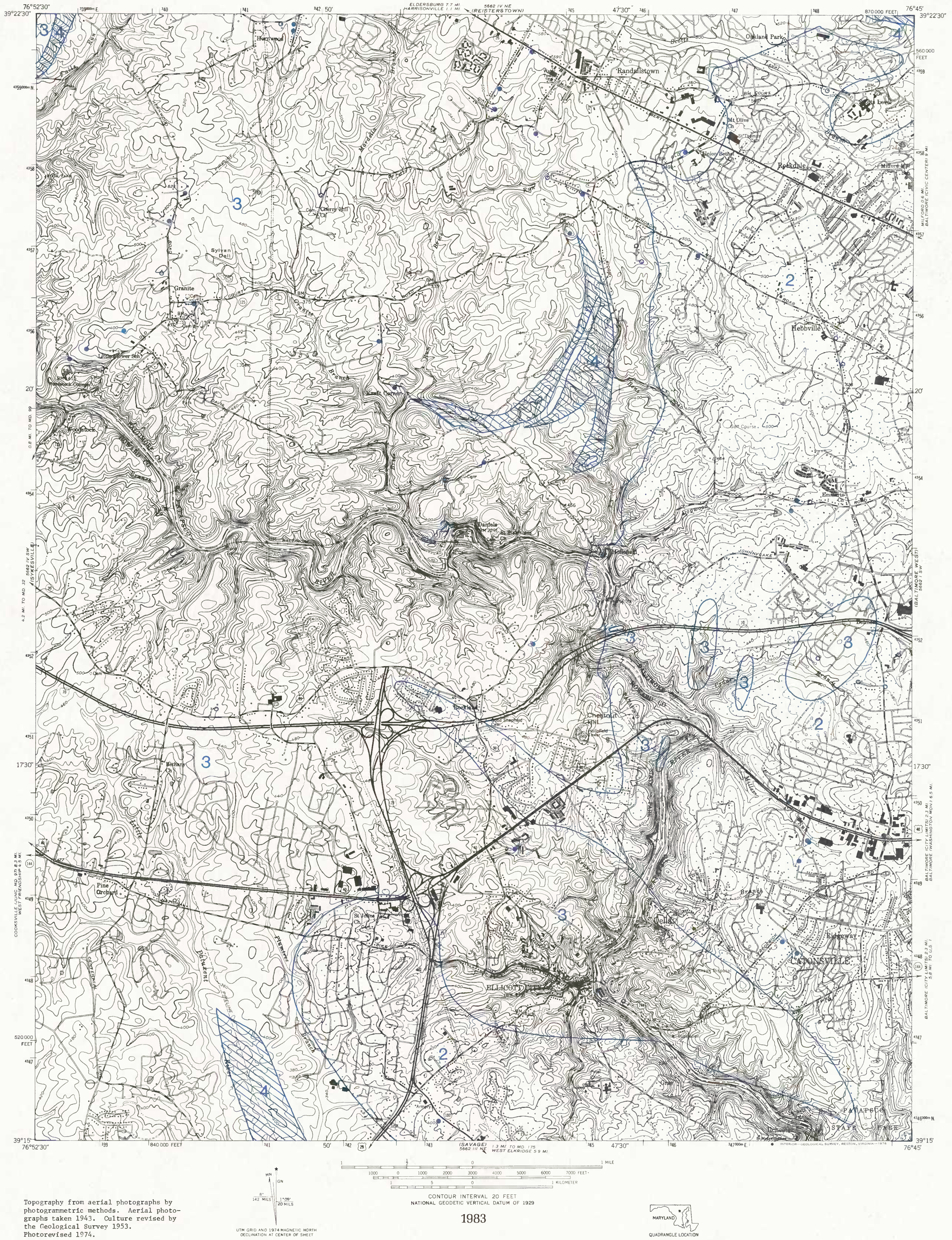
Hunt, Joel, 1978, How much is enough? A minimum well formula: Water Well Journal, v. 32, no. 2, p. 53-55.

Rohlf, F. J., and Sokol, R. R., 1969, Statistical tables: San Francisco, W. H. Freeman, 253 p.

Sokol, R. R., and Rohlf, F. J., 1969, Biometry: San Francisco, W. H. Freeman, 776 p.

MAP 4. AVAILABILITY OF GROUND WATER

Maryland Geological Survey | Quadrangle Atlas No. 21



Topography from aerial photographs by photogrammetric methods. Aerial photographs taken 1943. Culture revised by the Geological Survey 1953. Photorevised 1974.

1983

GEOHYDROLOGIC CONSTRAINTS ON SEPTIC SYSTEMS

By

Mark T. Duigon

INTRODUCTION

Where centralized sewage systems are not available, wastes from individual homes must be disposed of in comparatively small areas within the lot. These wastes are composed of many different substances, including urine, fecal matter, laundry detergents and cleaning compounds, and food scraps--all transported out of the house as a slurry by mixing with large quantities of water. These substances must be reduced in quantity or deactivated; otherwise, harmful conditions may become established in the environment and perhaps adversely affect the water-supply system.

The usual disposal method is to pipe the slurry into a septic tank which separates the liquid from solids and greases, and partially decomposes some of the solid material. The effluent is then directed into a seepage pit or tile field for distribution into soil. As the effluent percolates downward toward the water table, the soil filters and absorbs most deleterious substances.

Careful construction and maintenance of disposal systems are essential. Although it is recognized that these systems have a limited life span, failure is often accelerated by negligent construction and lack of periodic maintenance. Systems operating according to different principles may be more effective, but if not maintained properly, they may lose their effectiveness and fail more readily than conventional systems. Warshall (1979, p. 24,25) discusses several different types of disposal systems that may work effectively in some areas where conventional systems will not.

CONSTRAINT FACTORS

1. Flood hazard: Disposal systems do not drain properly when flooded and may be physically damaged. Contamination of surface water is possible when flood waters mix with effluent, and can spread to ground-water supplies.

2. Shallow water table: If effluent enters the ground-water system before it has passed through enough soil for adequate renovation, it is very likely to contaminate the system. A separation of several feet is required from the base of the seepage system to the water table.

3. Depth to bedrock: Fractures in bedrock act as ground-water conduits, and renovation of effluent is not effective. Therefore, a sufficient thickness of unconsolidated material between the base of the seepage system and the bedrock surface is required.

4. Slope: Steep slopes generally have a fairly thin soil cover and are likely to allow effluent to emerge at the surface. Baltimore and Howard Counties allow a maximum slope of 25 percent. Sternberg (written commun., 1974) concluded that, where the slope exceeds 20 percent, effluent will come to the surface downhill of a drainfield regardless of soil type or depth of trenches. Slope categories for this map were obtained from Map 1.

5. Infiltration rate: This factor affects the design of the disposal system. If infiltration is too slow, drainage will be sluggish and effluent may back up through the plumbing system. If too fast, renovation will be inadequate. In Maryland, the infiltration rate is evaluated at the site by a percolation test [1/].

Most of these factors are individually evaluated and tabulated by the U.S. Department of Agriculture, Soil Conservation Service (Reybold and Matthews, 1976; Matthews and Hershberger, 1968) for each of the mapping units of the county soil surveys. These evaluations, in addition to field observations by the author, other information in this atlas, and consideration of percolation tests by county officials, provide the basis for the categories shown on this map. This map cannot substitute for onsite evaluations, as discusssed in the section, Limitations of Maps.

MAP UNITS

UNIT I: Disposal facilities constructed in this unit face a high probability of failure. This unit generally occurs adjacent to streams and lakes where the water table is shallow and flooding can be a hazard. Other constraining factors are land slopes exceeding 25 percent and the presence of soils of low permeability (less than 0.63 in./hr, equivalent to greater than 95 min/in.). This unit includes areas underlain by soils developed on alluvium and subject to flooding, such as the Hatboro silt loam and the Codorus silt loam. It also includes areas of steep, stony soils and soils characterized by high water tables, such as the Kelly series and the Aldino series. Some areas within this unit may be modified to allow installation of disposal systems. This can be done by such methods as artificially lowering the high water table with curtain drains. Variations of system design may work effectively in this unit.

UNIT II: Conditions in this unit are not as severe as in Unit I, but they may work in combination to adversely affect disposal systems. Because of its variability and marginality, careful onsite evaluation is of particular importance. This unit includes areas having moderate (15 to 25 percent) slopes and areas having scattered outcrops or stony soils. It also includes areas that have been cut, filled, graded, or otherwise modified and therefore difficult to predict the characteristics necessary to estimate suitability for disposal systems.

UNIT III: Conditions in this unit are generally most favorable for installation of disposal systems. Onsite inspection is still required to determine the characteristics of particular sites. The unit generally covers well-drained interfluvial areas underlain predominantly by Glenelg, Manor, and Legore soils having slopes less than 15 percent. Permeability varies (0.63 to 6.3 in./hr or 95 to 9.5 min/in.), but is generally adequate. The water table and bedrock are generally at depths greater than 6 ft from land surface.

1/ The percolation test in Baltimore County consists of digging at least two holes to bedrock or as deep as the backhoe will dig (about 16 ft). This is to determine if the water table or bedrock surface is high. A lateral extension of the first hole is dug to an approximate depth of 5 ft (initially), and, at the bottom, a 1x1x1-ft hole is hand-dug. This small hole is filled with water to a level of 7 inches. The level is allowed to drop 1 inch and then is timed as it drops a second inch. The test is considered successful if the level takes from 2 to 30 minutes to drop the second inch. If the test fails, it is repeated at a greater depth or at another location. A proposed building lot must have a successful percolation test before a building permit will be issued, if sewage is to be disposed onsite. The county health official performing the test also notes any other factors that may affect operation of the disposal system, such as impermeable layers. The percolation-test method in Howard County is similar, except that 4 to 5 holes are dug per 10,000-ft^2 area and the size of the drainage system is determined from tabulated values of size versus percolation rate.

SELECTED REFERENCES

Baker, F. G., 1978, A model for planning and location of on-site waste disposal systems: Water Resources Bulletin 14, no. 1, p. 144-156.

Bender, W. H., 1971, Soils and septic tanks: U.S. Department of Agriculture, Soil Conservation Service, Agriculture Information Bulletin 349, 12 p.

Bouma, Johann, 1971, Evaluation of the field percolation test and an alternative procedure to test soil potential for disposal of septic tank effluent: Soil Science Society of America Proceedings, v. 35, no. 6, p. 871-875.

Coulter, J. B., Bendixen, T. W., and Edwards, A. B., 1961, Study of seepage beds: Report to the Federal Housing Administration (revised): Public Health Service, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, 62 p.

Derr, B. D., Matelski, R. P., and Petersen, G. W., 1969, Soil factors influencing percolation test performance: Soil Science Society of America Proceedings, v. 33, p. 942-946.

Healy, K. A., and Laak, Rein, 1973, Factors affecting the percolation test: Journal Water Pollution Control Federation, v. 45, no. 7, p. 1508-1516.

_______1974, Site evaluation and design of seepage fields: American Society of Civil Engineers, Journal Environmental Engineering Division, v. 100, no. EE5, Proceedings Paper 10882, p. 1133-1146.

Huddleston, J. H., and Olson, G. W., 1967, Soil survey interpretation for subsurface sewage disposal: Soil Science, v. 104, no. 6, p. 401-409.

Johnson, D. E., 1978, Selecting sewerage systems to fit site conditions and budget: Civil Engineering, v. 48, no. 9, p. 90-93.

Matthews, E. D., and Hershberger, M. F., 1968, Soil survey of Howard County, Maryland: U.S. Department of Agriculture, Soil Conservation Service, 104 p.

McGauhey, P. H., and Winneberger, J. H., 1964, Studies of the failure of septic tank percolation systems: Journal Water Pollution Control Federation, v. 36, no. 5, p. 593-606.

Miller, J. C., 1972, Nitrate contamination of the water-table aquifer in Delaware: Delaware Geological Survey Report of Investigations No. 20, 36 p.

Morris, J. G., Newberry, R. L., and Bartelli, L. J., 1962, For septic tank design, soil maps can substitute for percolation tests: Public Works Journal, v. 93, no. 2, p. 106-107.

Reybold, W. U., III, and Matthews, E. D., 1976, Soil survey of Baltimore County, Maryland: U.S. Department of Agriculture, Soil Conservation Service, 149 p.

U.S. Department of Health, Education, and Welfare, Public Health Service, 1967, Manual of septic-tank practice (revised): Publication No. 526, 92 p.

Viraghaven, T., and Warnock, R. G., 1976, Ground-water quality adjacent to a septic tank system: American Water Works Association Journal, v. 68, no. 11, p. 611-614.

Warshall, Peter, 1979, Septic tank practices: Garden City, New York, Anchor Press/Doubleday, 167 p.

Wright, F. B., 1977, Rural water supply and sanitation (3rd ed.): Huntington, N.Y., Robert E. Krieger Publishing Company, 305 p.

Prepared in cooperation with the United States Geological Survey and the Baltimore County Department of Planning and Zoning.

MAP 5. GEOHYDROLOGIC CONSTRAINTS ON SEPTIC SYSTEMS

Maryland Geological Survey

Quadrangle Atlas No. 21

Topography from aerial photographs by photogrammetric methods. Aerial photographs taken 1943. Culture revised by the Geological Survey 1953. Photorevised 1974.

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1983

MARYLAND
QUADRANGLE LOCATION

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

HYDROGEOLOGIC QUADRANGLE ATLAS NO. 21

ELLICOTT CITY QUADRANGLE MARYLAND

by Mark T. Duigon

INTRODUCTION

This altas describes the hydrogeology of the Ellicott City 7 1/2-minute quadrangle in southwestern Baltimore County and northeastern Howard County, Maryland (fig. 1). The information contained herein is intended for use by planners, health officials, developers, environmental consultants, and anyone else concerned with baseline hydrogeologic data and the effects of hydrogeologic factors on development.

The Ellicott City quadrangle lies within the eastern division of the Piedmont physiographic province. The land surface is generally undulating. Stream valleys vary from steep to gentle.

The climate of this area is humid temperate, with an average annual temperature of 54°F and an average annual precipitation of 41 in. (Vokes and Edwards, 1974).

The Patapsco River which divides Baltimore and Howard Counties drains most of the quadrangle area. The Patuxent River drains the southwest corner of the quadrangle. Gwynns Falls, which empties into the Middle Branch of the Patapsco River drains a narrow portion of the eastern edge and the northeastern part of the quadrangle.

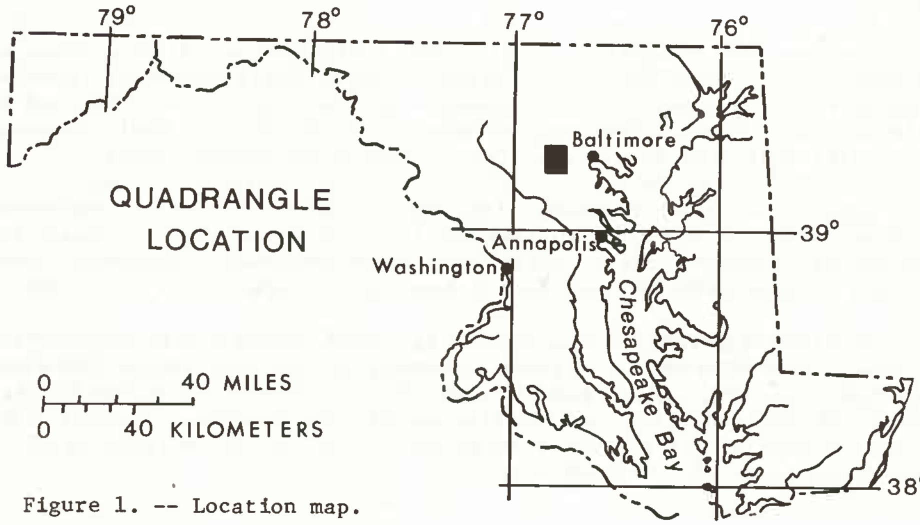


Figure 1. -- Location map.

A permanent gaging station, located on the Patapsco River about 0.3 mi south of Hollofield, has monitored daily flow since 1944. Low flow has been estimated for a site on the Little Patuxent River 0.4 mi east of Pine Orchard by correlation with a downstream station (Walker, 1971, p. 153).

Interstate 70 and U.S. 40 are major highways leading west from Baltimore City. U.S. 29, leading from Washington, D.C., presently terminates near the center of the quadrangle. Liberty Road (Md. 26), leading northwest from Baltimore, provides a corridor along which extensive suburban residential and commercial development has occurred. Residential development has also occurred in the south and east portions of the quadrangle.

GEOLOGY and SOILS

The stratigraphic nomenclature used in this report is that proposed by Crowley (1976) and does not necessarily follow the usage of the USGS.

The oldest rocks in the Ellicott City quadrangle belong to the Baltimore Gneiss, of Precambrian age. This unit formed a shelf in Paleozoic time upon which various clastic and carbonate sediments were deposited. Downwarping and uplift of this continental edge were controlled by plate-tectonic activity and sedimentation. The sediments that accumulated belong to the Glenarm Supergroup. Continued convergent plate motion resulted in the development of large thrust faults that stacked mafic and ultramafic rocks (Baltimore Mafic Complex) upon one another. Compressive forces relaxed, and erosion followed. The stacked thrust sheets were subsequently emplaced northwestward onto the former shelf, and the entire section was subjected to erosion and injection by granitic material, forming bodies such as the Ellicott City Granite and its associated injection complex.

The youngest crystalline rocks in the quadrangle are diabase dikes of Mesozoic age. These dikes were intruded along north-northeast-trending fractures in the older rocks. Exposures of these rocks are rare, and in this area they have no topographic expression but, rather, their presence is usually indicated by surface distribution of weathered clasts.

Lower Cretaceous sediments (Patuxent Formation) overlie the crystalline rocks in the southeastern part of the quadrangle. These are continental sands, gravels, silts, and clays that were deposited along braided to meandering streams and in associated flood plains and swamps.

Alluvial deposits of Quaternary age occur chiefly along perennial streams. Characteristics of these sediments depend upon source rocks and geomorphic setting. Accelerated rates of deposition have occurred as a result of deforestation and initiation of agriculture. Current construction regulations require erosion and sedimentation controls to mitigate the effects of increased erosion.

Mechanical and chemical agents of weathering have been affecting the rocks of the Piedmont since Mesozoic time. The altered material formed at the surface of rock (or sediments) is known as soil. The nature of a soil at a particular location is a function of several parameters called factors of soil formation (Jenny, 1941):

$$s = f\ (cl,\ o,\ r,\ p,\ t,\ \ldots).$$

This simply states that a particular soil's characteristics (s) are a result of the interaction of climate (cl), biological activity (o), topography (r), parent material (p), time (t), and other factors. Therefore, even though the bedrock in the area of the Ellicott City quadrangle is quite uniform, minor differences in the other soil-forming factors have led to the development of different soils.

HYDROLOGY

Ground water stored in the intergranular pore spaces of unconsolidated soil material (overburden) is transmitted through the crystalline rocks of the Piedmont by means of fractures and joints. Most wells in the Piedmont are drilled through the overburden and into fresh rock. The amount of water produced by such a well depends, in part, on the number of fractures that the hole intersects and the extent of the network of intersecting fractures. Figure 2 is a diagram of ground-water occurrence in the Piedmont showing the hydrogeologic factors involved in well performance.

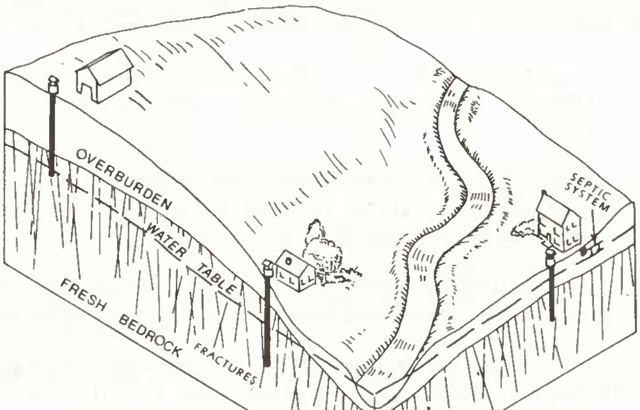


Figure 2. -- Wells in Maryland Piedmont. Well 'A' may go dry during a drought as the water table is lowered. Well 'B' intersects more interconnecting fractures and is assured a good supply, even if the water table is lowered. Well 'C' yields a sufficient amount of water but is subject to contamination from the septic system located up-gradient.

The generalized pattern of water circulation is known as the hydrologic cycle (fig. 3). The hydrologic cycle is the idealized movement of water as it is recycled through the earth and atmosphere. Water may be temporarily detained, but net losses or gains to the hydrologic cycle are negligible. A quantitative evaluation of the hydrologic cycle in a particular region can be made by use of the hydrologic budget:

$$P = R + ET + \Delta S$$

where

P = precipitation,

R = runoff,

ET = evapotranspiration, and

ΔS = change in storage.

Precipitation is the source of water in the Piedmont and is balanced by losses due to surface flow (runoff); release back into the atmosphere as water vapor (evapotranspiration); and changes (gain or loss) in the amount of water in storage in the ground.

Water quality is affected by the substances with which the water comes into contact. Ground water usually dissolves some of the minerals present in the rock and soil through which it passes. The intended use determines the suitability of water of a particular chemical nature: Water that is fit to drink may not be suitable for certain industrial applications. Steam boilers, for instance, require water that has a lower dissolved mineral content than potable water.

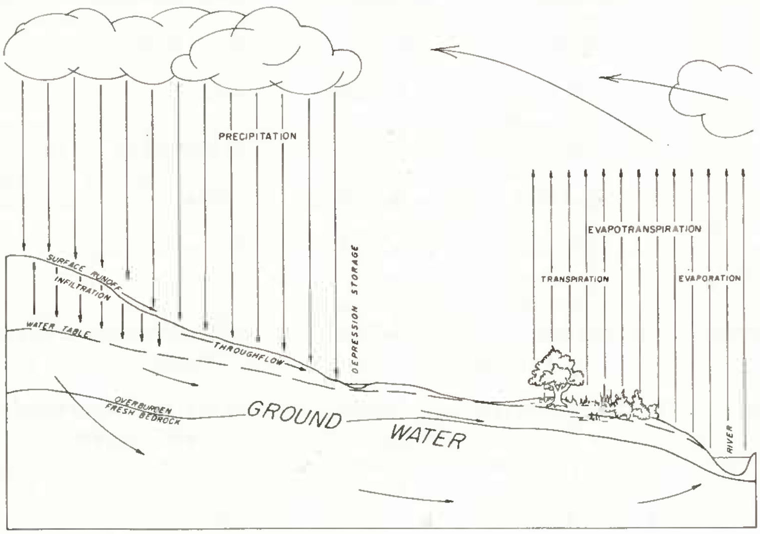


Figure 3. -- The hydrologic cycle.

MAPS INCLUDED IN THIS ATLAS

The information in this atlas is presented as five maps, each prepared on a standard 7 1/2-minute topographic quadrangle base:

1. Slope of the Land Surface, by Maryland Geological Survey.
2. Location of Wells and Springs, by Mark T. Duigon.
3. Depth to the Water Table, by Mark T. Duigon.
4. Availability of Ground Water, by Mark T. Duigon.
5. Geohydrologic Constraints on Septic Systems, by Mark T. Duigon.

These maps are designed for broad planning purposes and are not intended to substitute for detailed onsite investigations where required. Boundaries may not be exact because of map scale, data quality and distribution, and judgment required for interpolation.

CONVERSION OF MEASUREMENT UNITS

In this atlas, figures for measurements are given in inch-pound units. The following table contains the factors for converting these inch-pound units to metric (System International or SI) units:

Inch-pound Unit	Symbol	Multiply by	For Metric Unit	Symbol
inch	(in.)	25.40	millimeter	(mm)
foot	(ft)	0.3048	meter	(m)
mile	(mi)	1.609	kilometer	(km)
gallon	(gal)	3.785	liter	(L)
gallon per minute	(gal/min)	0.0631	liter per second	(L/s)
gallon per day	(gal/d)	0.0438	cubic meter per second	(m^3/s)
gallon per minute per foot	[(gal/min)/ft]	0.2070	liter per second per meter	[(L/s)/m]

SELECTED REFERENCES

Baltimore County Office of Planning and Zoning, 1970, Western Run Watershed, plan for 2020: Baltimore County Technical Report, 40 p.

Cloos, Ernst, 1964, Review of the Post-Triassic rocks, in The geology of Howard and Montgomery Counties: Maryland Geological Survey, p. 18-26.

Crowley, W. P., 1976, The geology of the crystalline rocks near Baltimore and its bearing on the evolution of the eastern Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 27, 40 p.

Crowley, W. P., and Reinhardt, Juergen, 1980, Geologic map of the Ellicott City quadrangle, Maryland: Maryland Geological Survey, scale 1:24,000, 1 sheet.

Dingman, R. J., Ferguson, H. F., and Martin, R. O. R., 1956, The water resources of Baltimore and Harford Counties: Maryland Department of Geology, Mines and Water Resources [1/] Bulletin 17, 233 p.

Fisher, G. W., 1964, The Triassic rocks of Montgomery County, in The geology of Howard and Montgomery Counties: Maryland Geological Survey, p. 10-17.

Hopson, C. A., 1964, The crystalline rocks of Howard and Montgomery Counties, in The geology of Howard and Montgomery Counties: Maryland Geological Survey, p. 27-215.

Jenny, Hans, 1941, Factors of soil formation: New York, McGraw-Hill Book Company, 281 p.

Nutter, L. J., 1974, Well yields in the bedrock aquifers of Maryland: Maryland Geological Survey Information Circular 16, 24 p.

Nutter, L. J., and Otton, E. G., 1969, Ground-water occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56 p.

Southwick, D. L., and Fisher, G. W., 1967, Revision of stratigraphic nomenclature of the Glenarm Series in Maryland: Maryland Geological Survey Report of Investigations No. 6, 19 p.

Vokes, H. E., and Edwards, Jonathan, Jr., 1974, Geography and geology of Maryland (revised): Maryland Geological Survey Bulletin 19, 242 p.

Walker, P. N., 1971, Flow characteristics of Maryland streams: Maryland Geological Survey Report of Investigations No. 16, 160 p.

1/ The name of this agency was changed to the Maryland Geological Survey in June 1964.

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